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A Postglacial Muskox *(Ovibos Moschatus)* from Grandview, Manitoba, and Comments on the Zoogeography of *Ovibos*

By C. R. Harington

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Location of the Grandview specimen and some other Pleistocene *Ovibos* remains (dots) in relation to Lake Agassiz as it existed about 8,700 years B.P., 13

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RÉSUMÉ

La méthode de la datation par radiocarbone a permis de fixer à l'an 8620 ± 190 B.P. (avant 1950 de notre ère) l'âge d'un fragment de crâne de bœuf musqué découvert dans un dépôt de gravier près de Grandview, au Manitoba. Par des comparaisons craniométriques, on a pu rattacher ce vestige à l'espèce *Ovibos moschatus*, qui vit encore de nos jours dans la zone arctique du Canada et du Groenland. L'*Ovibos*, qui est adapté à la vie de la toundra, a certainement pénétré en Amérique du Nord en partant de l'Eurasie, pendant la glaciation de l'Illinois. Au cours de la glaciation du Wisconsin, l'espèce aurait survécu dans des refuges naturels, l'un situé dans les îles de la partie occidentale de l'Arctique canadien, un autre près du détroit de Béring et un dernier au sud des glaces du Wisconsin. On croit généralement que le spécimen de Grandview provient de troupeaux de bœufs musqués qui ont quitté ce dernier refuge pour se déplacer vers le nord, en suivant la zone de toundra qui bordait les glaces fondantes du Wisconsin, jusqu'à leur habitat actuel, dans la partie continentale des Territoires du Nord-Ouest.

SUMMARY

A muskox cranial fragment from a gravel deposit near Grandview, Manitoba, has been radiocarbon dated at 8,620 ± 190 years B.P. Craniometric comparisons show that the specimen is referable to *Ovibos moschatus*, which survives in arctic Canada and Greenland. *Ovibos* — a tundra adapted animal — evidently first entered North America from Eurasia during the Illinoian glaciation. During the Wisconsin glaciation the species apparently survived in a Western Canadian Arctic Islands refugium, a Beringian refugium, and a refugium south of the Wisconsin ice. It is postulated that the Grandview specimen represents muskox herds that moved north from the latter refugium with the tundra zone bordering the backmelting Wisconsin ice until they reached their present range on the Northwest Territories mainland.

Introduction

Muskoxen of the genus *Ovibos* are gregarious, stockily built, hoofed mammals with downward deflected horns. Thick underwool and long, hanging guard hairs help to protect them against severe winter weather, typical of the tundra zone, to which they are particularly adapted. *Ovibos* remains are interesting because of their palaeoenvironmental implications. They are considered to be reliable tundra, or more rarely, loess-steppe indicators (Zeuner 1959; Ray and Harington MS.). In North America, *Ovibos* fossils from Alaska, the Yukon Territory, Banks Island, southern Alberta, Manitoba, Ontario, and the northern United States suggest that tundra-like conditions existed in those areas during the late Pleistocene.

The Grandview specimen is discussed here not only because of its palaeoenvironmental implications and its being the first recorded fossil muskox from Manitoba, but also because it appears to be an important piece of zoogeographic evidence linking muskox herds that survived in a narrow tundra belt south of the Wisconsin ice with those existing in the mainland Northwest Territories. This evidence is then considered in relation to the general dispersal history of *Ovibos*.

Acknowledgements

I am grateful to Mr. W. Crossley of Grandview, Manitoba, for allowing me to examine the muskox skull fragment and for providing me with a sample of bone from the specimen for radiocarbon dating. I also wish to thank Dr. R. W. Klassen, Geological Survey of Canada, for stratigraphic information about the fossil locality; and Dr. N. K. Vereshchagin, Zoological Institute of the Academy of Sciences of the U.S.S.R., for providing a radiocarbon date on a Siberian muskox specimen.

Description, Locality, and Stratigraphy

Order ARTIODACTYLA

Family BOVIDAE

Genus *Ovibos*

Ovibos moschatus (Zimmerman) 1780

The specimen (in the private collection of Mr. W. Crossley; Plates I, II, III) is the posterior part of a cranium. The nasals and most of the maxillae are lacking: the horncores are worn to stubs. The specimen shows signs of stream erosion, and loading machinery has damaged the posteromedial area of the left hornbase. It is referred to an adult male of *Ovibos* because a median groove separates the massive hornbases. Although Gidley (1908) and Bensley (1923) named two species of *Ovibos* (*O. yukonensis* and *O. proximus* respectively) other than *Ovibos moschatus* in North America, these are considered to be conspecific with, and junior synonyms of, the latter species (Ray and Harington MS.). Because of this evidence and of the close craniometric similarity between the Grandview specimen and a series of recent muskox skulls (Table I), it is referred to *Ovibos moschatus*.

The skull fragment was discovered in the autumn of 1963 by a heavy equipment operator working at a gravel deposit on the south side of the Valley River, three miles east of Grandview (NE. ¼ Lsd. 10, sec. 28, tp. 25, rge. 23). It was buried under approximately ten feet of alluvial sand and gravel on the slip-off slope of a meander bend in the Valley River. The enclosing sand and gravel were deposited at an early stage of the river. The skull fragment was uncovered about five feet above the present channel bottom level (pers. comm. R. W. Klassen 1968).

Age and Palaeoenvironment

Bone from the specimen yielded a radiocarbon date of 8,620 ± 190 years B.P. (I-1623). From this information it is inferred that muskox herds inhabited a tundra-like environment in the Duck Mountain area, 30 miles or more from the western margin of Glacial Lake Agassiz during the period between its McCauleyville and Stonewall phases (*see* Elson 1967). At that time the Keewatin ice margin may have been 200 or 300 miles north of the muskox locality (Map)[1]. Grandview is now in a natural area classified as mixed woodland — the nearest tundra is now located over 500 miles to the north.

[1]The great distance of the ice front north of Grandview 8,600 years ago and the paleobotanical evidence for grassland in the Duck Mountain area about that time (Ritchie 1967) suggest that the radiocarbon date from bone of the Grandview muskox could be erroneously recent.

Bison were present in southwestern Manitoba about 9110 ± 110 years B.P. (Y-415, Barendsen *et al.* 1957), 500 years before the muskoxen apparently lived near Grandview. Palaeo-Indians evidently hunted the bison herds (Steinbring 1966). Some 2,000 years later (6,320 ± 140 years B.P., GSC-280, Dyck *et al.* 1965), bison were present in the Riding Mountain area. And the discovery of projectile points from a surface site near Duck River (Fiske 1964) indicates that Palaeo-Indian hunters spread northward (50 miles NNE. of Grandview) after their prey. Probably by that time muskoxen had moved much farther north.

It is interesting to note that the first explorers and fur traders entering the western Hudson Bay region encountered muskoxen well south of their present range. Henry Kelsey (Doughty and Martin 1929) hunted muskoxen north of Churchill in 1689, and Nicolas Jérémie (*see* Allen 1913) encountered them before 1720 near the Seal River, which is now in Manitoba. The most southerly record of muskoxen in historic times is of two animals sighted on the tundra between Churchill and York Factory, Manitoba, in 1897 (Preble 1902).

Zoogeography of Ovibos

In order to view the Manitoba find in context, it is advisable to consider its relationship to the general dispersal history of *Ovibos*. Although some conjecture is involved in an attempted reconstruction of this nature, it is useful to have a hypothesis to criticize and modify.

The Tribe Ovibovini probably originated in south-central Asia in the late Miocene and dispersed from the region in early Pliocene time. The earliest muskoxen seem to have been upland species, and it was probably not until a marked cooling of climate occurred in the Pleistocene, accompanied by a spreading of alpine flora onto the lower northern plains, that *Ovibos* and other lowland muskox genera (e.g., *Symbos*, *Bootherium*, and *Praeovibos*) evolved to fill the new environmental niches (Harington 1961).

The earliest known *Ovibos* remains are of early Middle Pleistocene (Mindel I) age from Süssenborn and Obergünzberg, Germany (Khalke 1964). *Ovibos* first appears in deposits of the 'Maximum' (Riss) glaciation in Siberia (Vangengeim 1967) and about the same time (Illinoian glaciation) in Alaska, according to Péwé and Hopkins (1967). The genus seems to have become extinct in Eurasia in late postglacial time. A radiocarbon date on muskox cranial bone from Taimyr (the northernmost part of the Siberian mainland) is reported as 3,790 ± 80 years B.P. (pers. comm., N.K. Vereshchagin 1968). Dr. Vereshchagin kindly supplied me with a bone sample from the same muskox cranium. A date of 2,910 ± 95 years B.P. was obtained, which confirms the relatively recent extinction of *Ovibos* in Eurasia.

At least two *Ovibos* specimens (from near Morrill, Nebraska, and Jinks Hollow, Illinois) of possible pre-Wisconsin age (Ray and Harington MS.) suggest that muskox herds reached tundra areas south of the Illinoian continental ice. If they did, presumably they shifted northward as continental ice melted back during the Sangamon interglacial. With subsequent expansion of the Wisconsin ice, *Ovibos* herds were probably isolated in refugia in the Western

Canadian Arctic Islands[1] (particularly Banks Island; *see* Dyck *et al.* 1965: 15, and Maher 1968), in the unglaciated areas of Alaska and the Yukon Territory (Beringian refugium), and in a narrow tundra belt south of the ice.

Most *Ovibos* specimens in a zone from Montana to New York are probably of Wisconsin age. In eastern North America (near Vestal, New York, and Toronto, Ontario) *Ovibos* survived until the end of the Wisconsin glaciation (Kitts 1953; Ray and Harington MS.). But that region appears to have been a cul-de-sac for muskoxen: they were prevented from dispersing northward to the tundra areas of Ungava by non-accessibility or absence of sufficient tundra range as the Labrador ice melted back. It is important to recognize the rapid replacement of early late-glacial tundra vegetation by open spruce forests or woodlands as the ice retreated from the region (*see* Dreimanis 1967: 669). Farther west, however, herds that inhabited Iowa, Minnesota, South Dakota, and Montana (Ray and Harington MS.) were probably able to follow a narrow tundra zone northwestward and northward as the Keewatin ice melted back, until they reached their present range in the Northwest Territories mainland. The Grandview specimen is a clue tending to confirm the reality of such a postglacial migration. It indicates that muskox herds ranged the western shore of Lake Agassiz (Map) when the Keewatin ice margin was not far to the north. *Ovibos* specimens from surface gravel deposits near Ponoka and Cold Lake, Alberta (Ray and Harington MS.), may also be of postglacial age. If so, they could represent ancestors of muskoxen now occupying the tundra north of Great Bear Lake.

Considering the uncertainty of the evidence for muskoxen in a Pearyland – Northern Ellesmere refugium during the Wisconsin glaciation, the present distribution of muskoxen in the Canadian Arctic Islands may be best explained by postulating a northeasterly and easterly movement from a Western Arctic Islands refugium (including Banks Island) as the ice melted back. Dispersal in this region was obviously achieved by herds moving from island to island over the sea ice.

A problem exists on Prince of Wales Island, which is mentioned here because it may be zoogeographically significant. Taxonomic study of muskox skull samples (Tener 1965) indicates that the Prince of Wales Island population is anomalous in having a mean tooth row length closest to mainland muskoxen[2] and in having styles on the upper molars characteristic of Arctic Islands muskoxen. This sharing of taxonomically important morphological characters suggests genetic mixing in an area of overlapping range—and, considering the taxonomic and geographic proximity of the groups, there is no reason why hybridization should not have occurred. Prince of Wales Island caribou are also anomalous, apparently for a different reason. Again, the island is a zone of contact between Arctic Islands (Peary caribou) and mainland tundra (barren-ground caribou) animals, but little gene flow is indicated (Manning and Macpherson 1961). Banfield (1961) has suggested that the two contiguous populations are exhibiting character displacement.

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[1]Evidence for the presence of muskoxen in a Pearyland – Northern Ellesmere refugium and for their southerly postglacial dispersal from that area is considered to be less certain than was previously suggested (Harington 1961, 1964).

[2]All living muskoxen have been referred to *Ovibos moschatus* by Tener (1965). He suggests the high Arctic animals are an incipient subspecies.

Evidently *Ovibos* herds were common and were widely distributed in the unglaciated area of Alaska and the Yukon (Beringian refugium) during the Wisconsin. Over seventy skulls from that area, most of which are in the Frick Laboratory, American Museum of Natural History, have been examined by the author. As postglacial warming progressed, muskox range contracted until herds were largely confined to the Arctic Slope of Alaska. *Ovibos* herds also seem to have survived on the Arctic Slope of the Yukon until about 3,000 years ago (*see* Mackay *et al.* 1961: 34). Yet it is interesting to note that *Ovibos moschatus* lived in the more southerly Stewart River area of the Yukon until 2830 ± 100 years B.P., according to a radiocarbon date on cranial bone (I-3568). The last muskoxen native to Alaska were believed to have been killed west of Point Barrow about 1858 (Allen 1913) or 1865 (Manville and Young 1965). Extinction of Beringian muskoxen is attributed mainly to a combination of climate change (acting initially to decrease suitable range) and increasingly effective human predation.

At present, the author is unable to distinguish Beringian from Northwest Territories mainland muskox specimens; this suggests that most differentiation occurred in the Western Arctic Islands refugium. The marked difference between mainland and island muskoxen may be accounted for by longer and more effective isolation of the muskoxen in the latter refugium, and/or by survival of relatively few animals there, which allowed genetic drift to occur more rapidly than in the other refugia.

Conclusions

The earliest known *Ovibos* remains are from the early Middle Pleistocene of Germany. In Siberia, *Ovibos* first appeared during the Riss glaciation and evidently crossed the Bering land connection to North America about the same time. North American muskoxen probably shifted northward during the Sangamon interglacial and became isolated in three refugia with subsequent expansion of the Wisconsin ice. The present distribution of muskoxen in the Canadian Arctic Islands may be explained by postulating a northeasterly and easterly dispersal from island to island over the sea ice from a Western Arctic Islands refugium. The range of muskoxen in the Beringian refugium apparently contracted as postglacial warming progressed, until herds were confined to the Arctic Slope of Alaska, where the last native muskoxen were killed by hunters about the middle of the nineteenth century. It is postulated that the Grandview muskox represents herds that survived in a third refugium south of the Wisconsin ice, then moved north with the tundra zone bordering the backmelting continental ice until they reached their present range in the Northwest Territories mainland. Prince of Wales Island may have been an area of overlap between muskoxen dispersing eastward from a Western Arctic Islands refugium and those dispersing northward from a southern refugium.

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TABLE I—CRANIOMETRIC COMPARISON OF THE GRANDVIEW SPECIMEN WITH RECENT *Ovibos Moschatus* SPECIMENS[1]

Specimens	Measurements (mm)[2]								
	1	2	3	4	5	6	7	8	9
O. moschatus Grandview, Man.	66.8	102.6	27.7	28.6	110.1	76.0	141.2	187.7	149.5
O. moschatus NMC–23320	67.4	109.8	30.6	30.0	113.3	75.6	133.4	190.9	155.6
O. moschatus NMC–34437	65.9	102.7	26.7	29.2	125.6	77.7	133.6	182.7	144.1
O. moschatus NMC–34438	63.2	103.1	25.9	25.0	127.5	83.4	138.2	187.2	143.6
O. moschatus NMC–23322	62.7	110.5	28.9	31.0	107.2	80.2	120.6	171.3	156.6
O. moschatus NMC–23297	65.8	112.5	32.1	30.0	111.8	85.8	132.8	190.6	150.6

[1]Specimens are adult males.

[2] 1–Basioccipital breadth
2–Maximum occipital breadth
3–Height of foramen magnum
4–Breadth of foramen magnum
5–Occipital depth (dorsal lip of foramen magnum to base of median groove on dorsal surface)
6–Occipital depth (dorsal lip of foramen magnum to nuchal crest)
7–Width of skull at constriction above nuchal crest
8–Maximum hornbase length (anterior–posterior)
9–Breadth of postorbital constriction

Plate I – Dorsal view, *Ovibos moschatus* cranial fragment from Grandview, Manitoba. Posterior part of left hornbase damaged by heavy equipment during excavation.

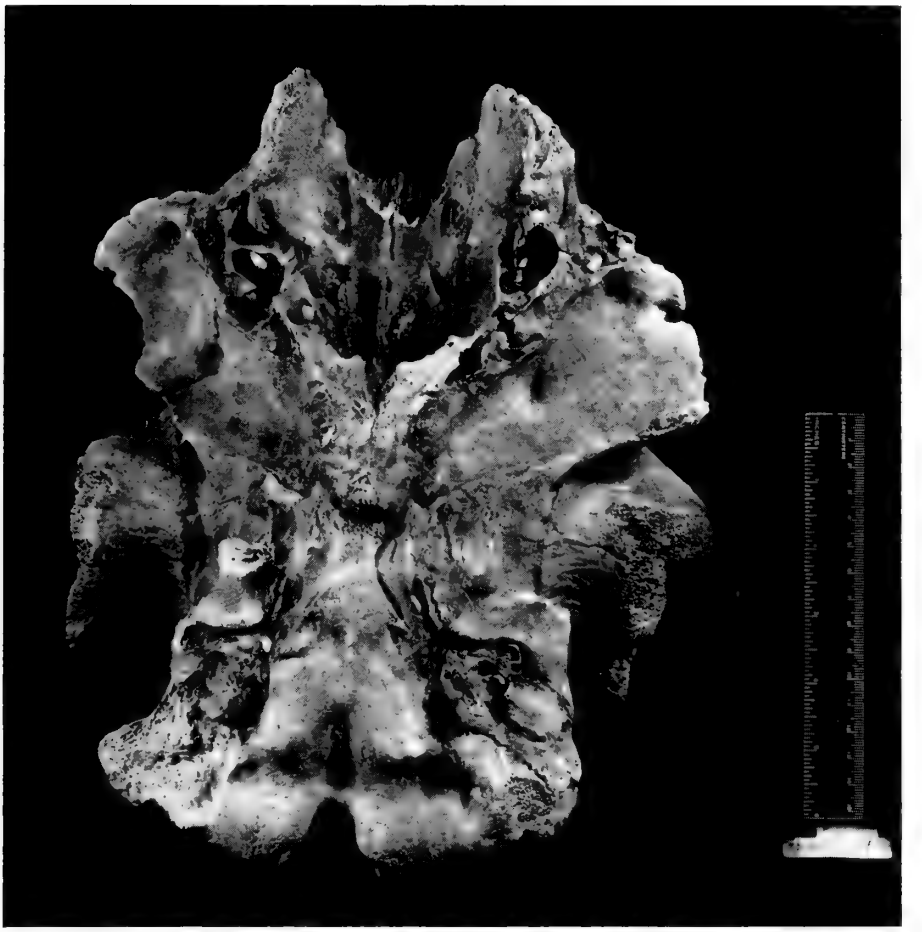
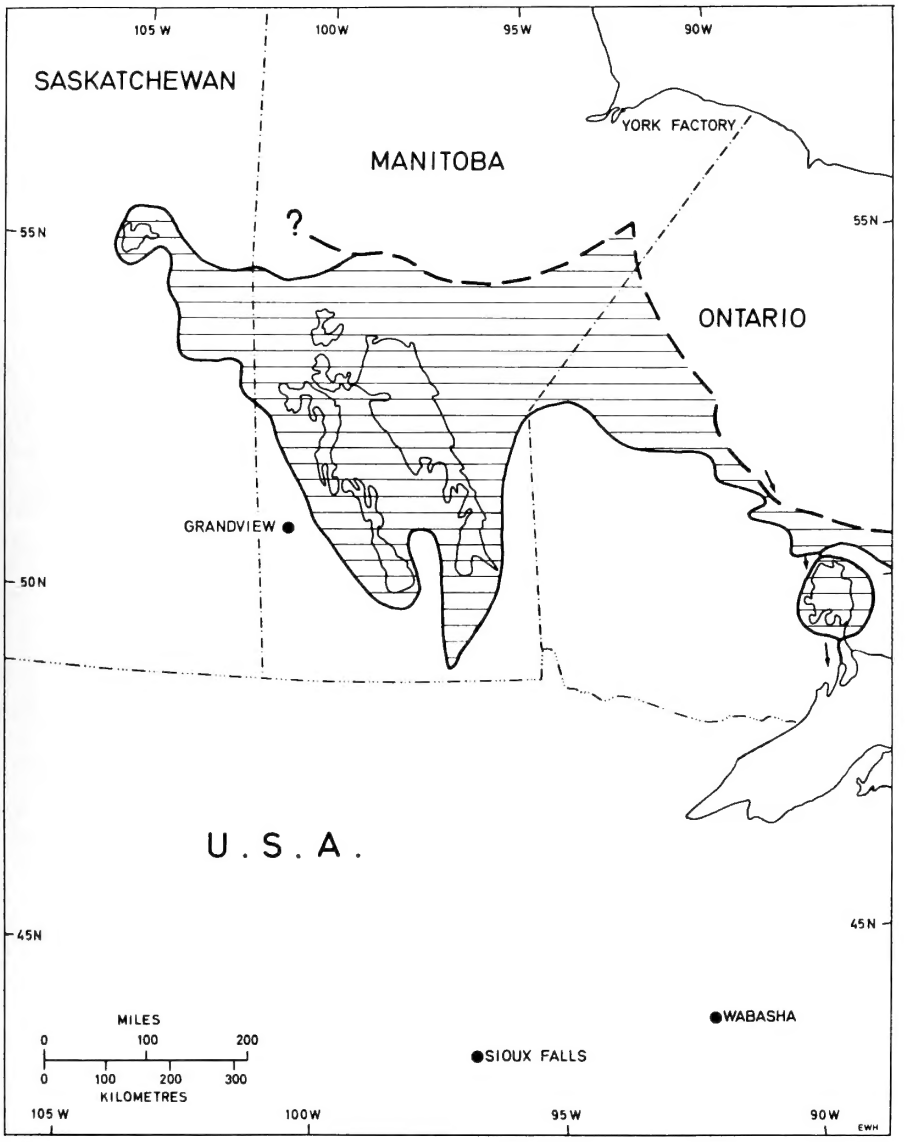


Plate II – Ventral view, *Ovibos moschatus* cranial fragment from Grandview, Manitoba.

PLATE III

Plate III – Posterior view, *Ovibos moschatus* cranial fragment from Grandview, Manitoba.



Map – Location of the Grandview specimen and some other Pleistocene *Ovibos* remains (dots) in relation to Lake Agassiz as it existed about 8,700 years B.P. (Elson 1967, Fig. 10; pers. comm. V. K. Prest 1968). Postulated Keewatin ice margin (dashed line) is shown north of the lake.